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# SURVEY NOTES

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Service to the State of Utah

May 1981

## UGMS DIRECTOR TO RETIRE



Mr. Donald T. McMillan, will retire on June 30, 1981 after serving seven years as the Director of the Utah Geological and Mineral Survey.

Don was a consulting geologist in Tucson, Arizona when he accepted the appointment as Director. He was formerly Vice-President of Exploration with Strauss Exploration, Inc., also in Tucson. Mr. McMillan is a native of Scarsdale, New York, holds a Master of Science degree from Montana School of Mines and has had over 30 years experience in mining and exploration geology.

As a USAAF pilot he led the first flight of 16 American planes into Japan  
(continued on pg. 2)

## \$4.7 MILLION TO BE PAID FOR ANTELOPE ISLAND

Antelope Island, a rugged, up-faulted block in the south arm of Great Salt Lake, is slated to become a new State park as the result of an out-of-court settlement between the owners, the Antelope Island Cattle Company (Anschutz Corporation), and the Division of Parks and Recreation. The agreement, involving payment by the State of \$4.7 million plus nearly \$150,000 interest, ended the State's condemnation proceedings against Anschutz, a multi-million dollar oil and gas and oil well drilling company.

The State won the first round of the condemnation fight in 1980. However, the decision of Judge J. Duffy Palmer of 2nd District Court, Davis County, stipulated that the State had to buy the mineral rights under the island from Anschutz in addition to acquiring the surface. This thorny issue led to further litigation over the combined value of surface and subsurface rights. In recent years, Anschutz also had conducted numerous geophysical surveys which purported to indicate valuable oil and gas and mineral potential on the island.

The trial began March 23 in Farmington with extensive testimony by witnesses for the Anschutz Corporation. Part of the testimony attempted to link the island to the oil-rich Thrust Belt of southwest Wyoming and adjacent northern Utah. However, after two days, the subsurface values were abruptly severed from the case, and testimony continued only on the value of the island as real estate. The \$4.7 million settlement which came after almost two weeks of added

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## PETROGRAPHIC MICROSCOPE TO AID COAL STUDIES

The Economic Geology Section of the Utah Geological and Mineral Survey has acquired a Leitz Ortholux research petrographic microscope and preparation center which will expand our capabilities to include identification of coal macerals, stages of coalification, and other petrographic applications. To the best of our knowledge, this is the first coal petrographic system of its type in the intermountain region and will give the Survey capability to do advanced research and identification of Utah's coal resources.

Coal particles will be embedded into a plastic plug, then its surface is highly polished using a fine diamond lap. The coal can then be examined under the special petrographic microscope using polarized light. A photometer of some sophistication attached to the microscope measures the light intensity reflected from a specific maceral in each sample enabling a determination of rank and other coal characteristics. The system has additional applications in the determination of degree of coalification, coking stability, fluorescence, liquefaction behavior, and others. This equipment will be extremely useful in the building of an information base and identification of Utah's coal resources.

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## DIRECTOR RETIRES

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at the end of World War II, landing at Atsugi airdrome, Yokahama with advance elements of the 15th Airborne Division in late August 1945. He retired with the rank of Lieutenant Colonel with the USAF Reserve.

In February 1976, Don moved UGMS from its cramped quarters on the University of Utah campus into our current building in Research Park. His policy has been to limit the growth of UGMS while providing more services to the citizens of Utah.

Don will continue to live in Salt Lake City, skiing, sailing and doing geological consulting.

## SUBSIDENCE, EPISODAL?

Differential settlement of four more homes has recently occurred in Cedar City — but this time in an area at the south end of town. Three years ago an area about 1½ miles to the north had a considerable number of homes affected by subsidence which a nine-month UGMS study determined to be caused by hydro-compaction. Following that study a public meeting was held at which Bruce N. Kaliser, Chief Engineering Geologist presented his data and conclusions. The issue has been a controversial one since then. UGMS Map 46, "Relative Hydro-compaction Susceptibility, Cedar City, Utah" was prepared by Mr. Kaliser and made available in quantity to the City for their distribution. The map is also available from UGMS. The newly damaged area is depicted on the map as being in the zone of "susceptible soils, deleterious soils likely to be moderately thick to thick". The map zonation consists of seven categories of susceptibility and is printed upon the USGS 7½' quadrangle base (1" = 2,000').

Cedar City has a requirement that applications for all new subdivisions in susceptible zones must be accompanied by a geotechnical report. The City, on its part, retains a geotechnical consultant to review all submittals.

## SIGHTS ON PUBLIC FACILITY SITES

### No. 5

Bruce N. Kaliser  
Chief Engineering Geologist

### LIFELINES

Lifelines are water, wastewater, energy, transportation and communication systems necessary for the livelihood of a community. Their importance is obvious from the definition.

Siting of these facilities differs from other public facility types primarily because of their linearity. To get from point A to point B with a primary artery or transmission line and to serve customers therefrom with a distribution net requires crossing considerable ground, often of diverse nature. Topography will frequently be the governing factor controlling the route selection for the lifeline. Terrain conditions haven't been a major consideration for very long. The requirement for environmental impact statements in recent years has furthered the cause for proper geologic siting of lifelines.

Some lifelines convey hazardous substances which not only must be conveyed but must also be confined for safety. Damage to the conveyance system with resulting spills can result in secondary effects below as well as on the surface which may be quite significant. Most lifelines comprise the infrastructure of urban areas. Quite clearly, damage will therefore directly effect considerable population. Many of the lifelines are required, more than ever, following a disaster. Water may be needed to douse fires; after an earthquake, emergency response vehicles will require an intact highway system; supplies may be needed to be flown in and landed on airport runways; power is requisite to accomplishing much; and communication links are vital to get any job done with unity of effort.

The clustering of lifelines into a corridor has distinct advantages prior to and after an earthquake. Less area is ultimately consumed for lifeline structures and there is far less hassle over acquisition of rights-of-way and environmental approval if a single corridor is established. However, concentration of

utilities means that siting factors become even more critical. Risk from geologic hazards becomes a paramount consideration or failures may be multiple.

Almost inevitably, major lifelines in Utah serving the Wasatch Front are going to cross active fault traces and unstable ground. Knowing the constraints of the terrain will assure an engineering solution which will reduce risks to an acceptable level and enable population centers to enjoy uninterrupted utility services.

## CRIB NEARS COMPLETION

UGMS field investigations of mineral occurrences to be included in the USGS Computer Resources Information Bank (CRIB) are nearing completion for the state of Utah.

Investigation for the State of Utah is scheduled to be completed by Spring 1982. The work is cooperatively funded by the BLM & UGMS.

## UGMS GEOTHERMAL ACTIVITIES

The Research Section of the Survey is currently making an assessment of the low temperature geothermal resources along the Wasatch Front. This work is being done by the Survey under contract with the U. S. Department of Energy, and is part of an overall evaluation of the low temperature geothermal resources of the State.

Within the Jordan Valley, water temperature, water chemistry plus gravity and aeromagnetic data have been collected. Temperature gradients within selected wells will be measured throughout the valley during the coming field season. An interpretation of this data, to be completed within the next year, will be published in report form containing text, maps and illustrations. Similar types of reports are also anticipated for Utah Valley and the Logan area in Cache Valley.

During May 4-6, Mr. Robert Klauk of the Survey attended the U. S. Department of Energy (DOE) sponsored meetings in Glenwood Springs, Colorado. During this time, representatives of the various State Resource Assessment teams presented papers on aspects of the state geothermal programs.

## ANTELOPE ISLAND

(continued from pg. 1)

testimony ironically was almost identical to the original purchase offer made by the State prior to the condemnation proceedings.

UGMS Assistant Director Howard Ritzma spent several months on the case working closely with the Attorney General's office in obtaining expert witnesses, planning testimony, designing exhibits, coaching attorneys, and guiding cross examination in court. Nine geological and geophysical exhibits prepared by the UGMS Illustration Section were never introduced in court. If the State's case on mineral values had been presented, the panel of witnesses would have included Ritzma, Dr. Robert Cohenour, consulting geologist, Salt Lake City; John Partridge, consulting geophysicist, Casper, Wyoming; and Dr. John D. Haun, consulting geologist, Evergreen, Colorado, and immediate past president of the American Association of Petroleum Geologists.

According to the settlement, the Anschutz Corporation retains the mineral (subsurface) rights on the island. It may drill a 20,000-foot well which was to have been spudded in late March, coincident with the first day of the trial. A large area on the northeast end of the island has been graded for a location and a road constructed to the drill site. Location for the test is on Precambrian rock, and Anschutz geologists anticipate that the well will penetrate a surficial thrust sheet, pass into Paleozoic rocks, and possibly cross another thrust fault into still younger rocks.

In addition to the mineral rights, Fred B. Anschutz, president of Antelope Island Cattle Company, retains an option for life on a 100-acre parcel on the island.

Full development of Antelope Island Park appears to be many years away since the Division of Parks and Recreation has no money set aside to implement its master plan for the island. 2000 acres on the north tip of the island have been a state park for about 10 years and will probably bear the brunt of park usage. For the present, the undeveloped part of the island probably will be used on a limited basis by back packers, hikers,

and swimmers. Some of the best and most scenic beaches on the lake are on the island's rocky west shore. The 40 square mile island supports a variety of wildlife including a small buffalo herd, Mouslan sheep imported from Spain, and deer - but no antelope.

## DAN MILLER NAMED

Dr. Daniel N. Miller, State Geologist of Wyoming and Director of the Wyoming Geological Survey, has been named Assistant Secretary of Interior for Energy and Minerals. Confirmation of the appointment by the U. S. Senate is expected to be routine.

The position is one of the key posts in the Interior Department and, considering the critical importance of energy and minerals to the nation, one of the important appointments in the Reagan administration. Dr. Miller's knowledge of Rocky Mountain regional geology will be of particular value in Federal/State relations in the West.

Utah Geological Association members will recall Dan Miller's enthusiastic and stimulating talk at a January luncheon meeting on "Mineral Activity in Wyoming with Emphasis on the Overthrust Belt" which ranged from huge reserves of oil to micro-quantities of diamonds.

We wish Assistant Secretary Miller well in his new responsibilities. Come see us, Dan, when things get too steamy in D. C.!

## IN MEMORIAM

Dr. Thomas R. Neff, professor of geology at Weber State College for 13 years, was killed in an automobile accident west of Delta, Utah, April 18. A native of Utah, Rod Neff received his B. S. and M. S. degrees in geology from the University of Utah and his Ph. D. from Stanford.

He was an active member of the Utah Geological Association and had assisted in many UGA activities and those of the Geological Society of America held in this area. The tragic death of Dr. Neff is a great loss to Weber State College and to the geologic profession in Utah.

## NEW THRUST BELT DISCOVERY AN OIL FIELD GIANT

The Anschutz Ranch, East field astride the Utah-Wyoming border about 15 miles south-southwest of Evanston may be one of the most significant discoveries in North America in two decades according to officials of Standard Oil Company (Indiana), parent company of Amoco Production Company, discoverer and 60% owner of the field. The announcement was made to security analysts in New York, April 1, and reported by the Wall Street Journal.

Amoco estimates potential oil and gas reserves in its share of the field at "the energy equivalent of 800 million to 1.2 billion barrels of oil". Other industry sources confirm the estimates, placing the field total at 1.2 billion barrels of oil, more than 4 trillion cubic feet of gas and more than 500 million barrels of gas liquids.

Howard Ritzma, assistant director of the Utah Geological and Mineral Survey and chief of its petroleum section, estimates the field covers about 12 square miles and that present well data indicates about 65% to 70% of the reserve lies in Utah. "It's Utah's first giant oil field in the Thrust Belt," he stated. Ritzma also estimated the economic potential of the field as follows:

"If the energy equivalent of 600 million barrels of oil is produced in the Utah portion of this field, at 1981 prices this will generate between 20 and 25 billion dollars of product. Utah's present 2% severance tax will generate 400 million to ½ billion dollars of tax income spread out over the life of the field, perhaps 35 to 40 years. Other economic benefits to the local and State economy from this discovery will be tremendous."

## DID YOU KNOW?

The daily average yield on an oil well at full production in Alaska's Prudhoe Bay field is 10,000 barrels; it is only 11 barrels in the lower forty-eight states.

## COPPER STRIKE REDUCES UTAH'S 1980 MINERAL PRODUCTION

The total value of non-fuel minerals produced in Utah in 1980 was \$744 million, according to preliminary figures published by the U. S. Bureau of Mines. This is down slightly from 1979's record high of \$753 million. Of this, \$589 million was for metals, down about \$20 million from 1979's \$609 million.

The Utah Copper Division of Kennecott Minerals Co. and the Carr Fork operation of the Anaconda Co., a subsidiary of Atlantic Richfield Co., accounted for more than three-fourths of the state's total value for metals. Copper ranked first, with almost 46% of the total metal value.

The total 1980 production of copper was nearly 40 million metric tons less than in 1979, due to the nationwide copper industry strike which began on July 1, 1980 and lasted for over two months. Copper production in the state was also affected when Anaconda was forced to close its mine for nearly three months because of accidental damage to its production shaft (figure 1).

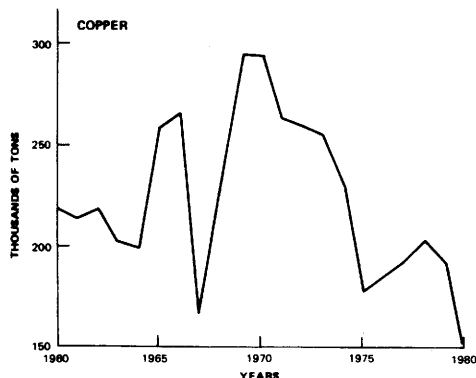


Figure 1. Production of copper in Utah, 1960-1980.

Gold, molybdenum, and silver, by-products of copper production, ranked next highest in recovered values, followed by iron and vanadium. Although the actual production of the gold and silver dropped along with the copper production, the rise in prices of these metals nearly offset the loss in copper values (figures 2 & 3).

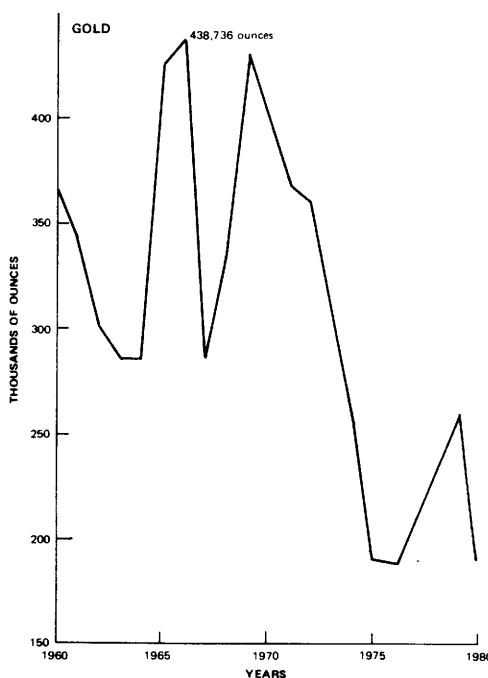


Figure 2. Production of gold in Utah, 1960-1980.

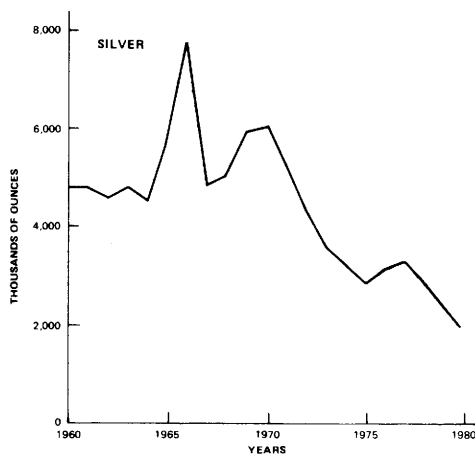


Figure 3. Production of silver in Utah, 1960-1980.

The high prices for gold and silver have encouraged activity in mining districts across the state; Noranda Mines, Ltd., has made its first shipments of lead-zinc-silver ore from the newly opened Ontario mine near Park City and is considering reopening the Mayflower mine, also near Park City. Ranchers Exploration and Development Corp. has continued development of its Escalante mine in Iron County, and has started construction of a 500 ton per day mill. Sunshine Mining Company has a lease option on the Burgin lead-zinc-silver mine in the Tintic area, and the Toledo Mining Company is doing a feasibility study of

its copper porphyry holdings near Milford in Beaver County.

Other metals produced in Utah are beryllium concentrate, iron, lead, magnesium, molybdenum, tungsten, uranium, vanadium and zinc.

The values of non-fuel non-metals produced in 1980 rose from 1979's \$144 million to \$155 million. Potash, cement, sand and gravel, stone, and phosphate were the leading commodities in the non-metal group. Martin Marietta Corp. has begun construction of a new \$85 million cement plant near Leamington, 100 miles south of Salt Lake City. Scheduled for completion in 1982, the plant is expected to produce 650,000 tons of cement per year.

Production of salt and gypsum showed sharp declines, possibly due to the generally slow economic situation.

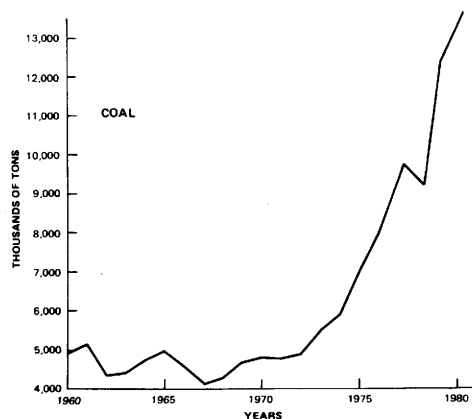
## MID VALLEY EARTHQUAKE EFFECTS

In a talk on earthquake effects given at the Kearns Library in Salt Lake County on March 14th, Mr. Bruce N. Kaliser, UGMS Chief Engineering Geologist, gave an account of how the valley might appear to the population of Kearns following a strong earthquake. Gaping ground cracks in the area were ruled out but clouds of dust would likely be observed along both the Wasatch and Oquirrh Mountain Fronts. He advised against any attempt to escape the valley because rock falls and mass movements of earth will most assuredly block the canyon arteries and I-15 and I-215 may well experience differential settlements which destroy the driving surface. Furthermore, the overpasses may well settle differentially with respect to the road embankment leading to them and, even worse, complete failure is possible. The major earthquake hazard in the Kearns area is likely to be from ground shaking which will put older buildings, particularly unreinforced masonry, to the test.

## FLASH FLOOD MONTH

By proclamation of Governor Matheson, May is "Flash Flood Awareness Month". The Great Salt Lake is also expected to reach peak level.

## UTAH COAL PRODUCTION, 1980



Coal production in Utah, 1960-1980.

Utah had another record coal production year in 1980 with a 12.7 percent increase over 1979. Producing more than 13.6 billion short tons, Utah mines provided coal for the electrical power generation industry (72.5 percent), for industrial users (14.8 percent), for metallurgical purposes (8.8 percent) and for space heating (3.9 percent). The mines shipped 42.7 percent of this coal to other states, 48.9 percent remained in Utah, and 8.4 percent was shipped to the Far East. In order of importance states using Utah coal included California, Nevada, Indiana, Mississippi, Arizona, Washington, Idaho, Wyoming and Montana.

Coal mines in the Wasatch Plateau coal field increased by 14.3 percent over last year's tonnage to 9,879,284 tons which amounted to 72.5 percent of the coal mined in 1980. The Book Cliffs field increased its production by 9.8 percent to 2,993,207 tons or 21.9 percent of the total. The remaining 5.6 percent was mined in the Emery coal field, which also increased its production over last year by 4 percent.

Emery County was the leading producer of coal in 1980, mining 6,323,354 tons for 46.4 percent of the total. This was an increase of 22.8 percent over last year. Carbon County produced 5,489,054 tons, or 40.3 percent, showing an increase of 3.7 percent over 1979. Sevier County was the only other to produce coal and its 1,821,510 tons amounted to 13.3 percent of the total and an increase of 9.9 percent over last year's production. The

coal was produced in about 25 mines, during 1980 at least 2 mines shut down as 2 were started up in other locations.

During the last decade, 1971-1980, Utah has produced 79.8 million tons of coal bringing total coal production (recorded) since 1870 to 398.9 million tons.

## CRITICAL FACILITIES

The Salt Lake City Corporation has consulted UGMS Chief Engineering Geologist Bruce N. Kaliser on the seismic analysis of two of its older concrete dams. The analyses are necessitated by U. S. Army Corps of Engineers Phase I inspections made in 1979. In their National Inventory of Dams, the hazard rating for both dams is "High" based upon the prospects for loss of life and property damage in event of failure.

Both structures are located in the high catchment area of Big Cottonwood Creek, in Salt Lake County.

Twin Lakes Dam is a rubble concrete gravity dam, 69 feet high and 680 feet long, with an upstream curvature.

Lake Mary Dam is a rubble concrete gravity dam also, but with a straight alignment. It is 76 feet high, 330 feet long.

Both dams are classified by the Corps as "small", meaning storage of more than 50 acre-feet and less than 1,000 acre feet. In the height category both are labeled "intermediate", with heights more than 40 feet and less than 100 feet. Overall classification for each is "Intermediate".

Dwellings and buildings in Brighton, a ski resort, are located immediately downstream in the potential inundation zone.

The seismic analysis for these dams is scheduled to be completed this year.

## GEM & MINERAL SHOW

The Mineral Society of Utah and the Wasatch Gem Society will host the Gemboree of the Rockies Show in the Salt Lake City Salt Palace, June 4-7.

## UGMS BOARD REORGANIZES; GETS NEW APPOINTEES

Governor Matheson appointed and the State Senate confirmed two new members of the UGMS Board: Dr. Lawrence H. Lattman, Dean of the Colleges of Mines and Mineral Industries and Engineering, University of Utah, and Peter Matthies, vice-president of Northwest Energy Company. Dr. Eliot Rich, professor of civil engineering, Utah State University, and Mr. Kenneth Poulson, vice-president, Brush-Wellman, Inc., were reappointed to the Board.

Carryover members of the Board are: Mrs. Natalie Mallinckrodt, civic leader; Robert W. Bernick, vice-president, Walker Bank and Trust Company, and Benton Boyd, retired coal executive.

Mr. Poulson was elected chairman of the Board and Dean Lattman was elected vice-chairman. A committee to screen applications for the position of new UGMS director was appointed to consist of Lattman (chairman), Mallinckrodt and Bernick.

Former Board member, Robert R. Norman, consulting geologist, Moab, was reappointed in the Board of Oil, Gas and Mining where he served for many years before his four-year stint with UGMS. The Board also commended Mr. Paul Dougan, former UGMS Board chairman, for his service to UGMS both as Board member (and chairman) and as a representative of UGMS on the Board of Great Salt Lake. Mr. Dougan, secretary of Equity Oil Company, did not seek reappointment.

## TOTAL VALUE OF MINERAL PRODUCTION IN UTAH, 1980 EXCEEDS \$2 BILLION

Petroleum	
(oil & gas, est.)	\$775,000,000
Coal (est.)	\$450,000,000
Copper (USBM)	\$342,000,000
Gold (USBM)	\$117,000,000
Silver (USBM)	\$44,000,000
Uranium (est.)	\$40,000,000
Balance	
non metals and	
non reported minerals	\$241,000,000

## ANTELOPE ISLAND ROCK DATED

Potassium-argon dating of a rock from Antelope Island has yielded a mild surprise. A gray-green, coarse-grained, granitic rock, part of a vein system within the Farmington Complex, yielded an apparent age of  $634 \pm 22$  million years, originally thought to be much older. Harold W. Krueger, Geochron Laboratories, Cambridge, Massachusetts, commented on the date as follows:

"... most feldspars from Precambrian rocks tend to lose approximately 35% of their radiogenic argon and we have also reported a probable true age of approximately 900 million years by correcting for this probable argon loss ...".

The rock was collected from a prospect tunnel in the center of NW¼, section 32, T. 3 N., R. 3 W., on the south side of Frary Peak, highest point on the island, in the head of Buffalo Scaffold Canyon. The analysis was part of the preparation for the Antelope Island litigation between the State of Utah and the Anschutz Corporation.

## WESTERN STATES SEISMIC POLICY COUNCIL MEETINGS HELD IN SALT LAKE CITY

The Western States Seismic Policy Council held its third annual meeting in Salt Lake City, Utah on March 27 and 28. States represented at the meetings included Alaska, Arizona, California, Colorado, Idaho, Missouri, Montana, Nevada, New Mexico, Tennessee, Utah and Washington.

UGMS chief engineering geologist Bruce N. Kaliser was a Utah representative. Mr. Kaliser represents the discipline of geology on the Utah Seismic Safety Advisory Council. Following the business meeting Mr. Kaliser led the participants on a walking excursion to examine seismic risk in downtown Salt Lake City. The walk began at Temple Square, the site of a diverse suite of structures of different ages, and finished in the tower of the Salt Lake City-County Building which is undergoing a retrofit at this time to resist seismic shaking.

The first session included an overview of regional tectonics presented by Lloyd Cluff, S. T. Algermissen and Roy Bailey. In the northwestern U. S., earthquake focuses average between 50 and 70 kilometers in depth. These focuses are considerably deeper than is normally found in the Intermountain Seismic Belt; therefore ground motion should be less severe in the northwest. Dr. Algermissen has modified his probabilistic map of ground motion to now include six maps to be released late in 1981. Three maps will depict seismic wave velocity and the other three will depict bedrock acceleration. All six maps will show what values could be expected in the next 10, 50 and 250 years which are termed as return periods.

Liquefaction, the failure of a relatively loose mass of cohesionless material, is a phenomenon UGMS believes to be a major concern in Utah, particularly along the Wasatch Front. For instance, as a result of the 1977 Bucharest (Rumania) earthquake, liquefaction occurred 200 km away from the epicenter with a force of only 1% gravity. For Utah, the 50 year return period bedrock acceleration map discussed above, shows that a 27% gravity force is possible. Liquefaction was also very severe in the recent Tangshan (China) earthquake. In that earthquake 70,000 water supply wells were destroyed, 64% of the total in that area.

In the luncheon session, architect Fred Montmoreny and structural engineer Reinhardt Brumek presented a recapitulation of the major retrofitting of the 30 year old Salt Lake City Veterans Hospital. This operation, unique to Utah, was completed on 13 buildings last year at a cost of \$8 million.

Afternoon sessions centered upon the topic of creating state programs for earthquake safety. One area of considerable concern is that officials are ignoring published documentation on earthquake hazards. In Anchorage, Alaska, for example, new residences are being established on a very unstable slide area which failed in the 1963 earthquake. It would seem that such flagrant violation of nature's laws would no longer be acceptable in the 1980's. Ezunial Burts of the mayor's office of Los Angeles addressed his city's newly passed ordinance governing the retrofitting of unreinforced

buildings. Approximately 1500 older buildings are now required to be brought up to Uniform Building Code standards. The time element for compliance shall be dependent upon the use and occupancy levels of the structures. Interestingly, elected officials of the city believed it to be politically expeditious to pass such a stringent ordinance in view of their obligation to plan for the city's future.

Tim Lynch, Administrative Assistant to Congressman George Brown (CA), addressed the evening session, speaking on the attitude of Congress towards earthquake legislation and renewed funding. Those in attendance, because of important roles in earthquake-hazard reduction in their respective states, were encouraged to make their feelings known to those in Congress.

Saturday morning's session concerned direction in federal earthquake programs. Programs of the U. S. Geological Survey, Federal Emergency Management Agency and National Science Foundation were summarized and debated by a panel of state representatives.

The morning session was followed with the business meeting, a walking excursion of downtown Salt Lake City, and the monthly meeting of the Utah Seismic Safety Advisory Council.

Next year's meeting will be hosted by the state of Arizona and will be held in the Phoenix area.

Utah's Seismic Safety Advisory Council's four-year life comes to an end on June 30th of this year.

## PERSONNEL CHANGES

Gary E. Christenson joined the UGMS staff in February and is working with the Site Investigations Section. He is an Engineering Geologist/Geomorphologist with a BS degree from Montana State University and an MS degree from Arizona State University. Prior to joining the UGMS, he worked for Fugro, Inc., consulting Engineers and Geologists in Long Beach, California.

Wilma A. Boone has accepted a new position with State Lands. Wilma has worked in the UGMS Editorial Department for almost 4 years.

## NEW PUBLICATIONS

*Minerals and Mineral Localities of Utah*, by Kenneth C. Bullock, UGMS Bulletin 117, 177 pages with 20" x 25" map of Utah showing locations of mining districts (in pocket). Price \$6.50 (\$7.25 postpaid), plus \$.33 sales tax for Utah residents.

A completely revised and updated edition of *Minerals and Mineral Localities of Utah*, by Kenneth C. Bullock, Professor of Geology at Brigham Young University, is now available for rockhounds, prospectors and mineralogists.

This bulletin, out of print for several years, fills a real need because of the renewed interest in the old mining camps of Utah, and for Utahns and tourists who seek relaxation out-of-doors as collectors of rocks and minerals. 136 mining districts are located on a relief map of the state (Scale: 1 inch equals about 16 miles).

The minerals found in each mining district are listed, and nearly 600 separate minerals occurring in Utah are described and the locations where they are found are given by county, district and mine.

Minerals are listed by the county in which they occur; by their crystal system, their chemical class, and by the metallic elements they contain. A comprehensive bibliography is included for those who are interested in more details of individual minerals or mining districts.

*Phosphate in Utah*, UGMS Circular 66, 32 p. Price \$3.00 (\$3.75 postpaid by mail; Utah residents add 15 cents state sales tax).

*Phosphate in Utah* describes the origin, distribution, geology and resources of phosphatic shale in Utah, and describes each of the potentially economic occurrences.

*Geology and Mineral Resources of Box Elder County, Utah*, by Hellmut H. Doelling, UGMS Bulletin 115, 250 pages with colored geologic maps and sections (Scale 1:250,000). Price \$13.00 (\$14.30 by mail, prepaid).

Box Elder County, in the northwest corner of Utah, covers 5,594 square miles of land and an additional 800 square miles of Great Salt Lake.

Part 1 of Bulletin 115 gives detailed descriptions of the rocks exposed in Box Elder County and their geologic structure. The oldest rocks are more than 2.5 billion years old; sedimentary rocks of nearly every age are present except those of the upper Mesozoic era. The pre-Mesozoic rocks are mostly of marine origin; these were complexly folded and faulted during late Mesozoic and early Tertiary time. Younger Tertiary and Quaternary deposits produced thick sequences of valley fill. The Tertiary rocks are largely river, lake and volcanic deposits and are relatively flat-lying. The overlying Quaternary deposits cover 70% of the county and include the very flat lakebed sediments left by Lake Bonneville.

The intrusive igneous rocks (granites) associated with copper, gold and silver mineralization range in age from 2.5 billion years to about 25 million years old.

The total value for mineral production in Box Elder County through 1974 was about \$132 million. Of this, sand, gravel and stone accounted for about 75%, most produced between 1956 and 1959 when the Southern Pacific Causeway was constructed.

Products from Great Salt Lake brines accounted for about 18% (\$23.5 million) and production of precious and base metals accounted for 6.6% (\$8.7 million) of the total values. Recorded metal production included 30,450 ounces of gold, 3.6 million ounces of silver, and 18 million pounds of copper. The geology of old mining districts is described in detail, and maps of important mines are included in the text.

Minor production has been reported for petroleum and lignite; the county has some potential for the production of uranium, thorium and geothermal resources.

*Summary of Oil and Gas Drilling and Production in Utah, 1979*, by Karl W. Brown and Howard R. Ritzma, UGMS Circular 67, 88 pages, \$3.00 (\$3.75 by mail, postpaid) plus 15 cents tax if sold in Utah.

This is a sequel to UGMS Circular 65, *Summary of Oil and Gas Drilling and Production in Utah, 1978*. Gives production by field.

*Geology and Petroleum Resources of the Major Oil-Impregnated Sandstone Deposits of Utah*, by J. A. Campbell and H. R. Ritzma, 1979, \$2.00 (\$2.75 by mail, postpaid) plus 10 cents tax if sold in Utah.

A second printing of a popular work; includes maps, sections, and statistical data.

*The Mississippian and Pennsylvanian (Carboniferous) Systems in Utah*, by John E. Welsh and Howard J. Bissell, UGMS Reprint 101, \$1.50 (\$2.25 by mail, postpaid) plus 8 cents tax if sold in Utah.

A complete description of the Carboniferous rocks of Utah, with outcrop maps, correlation charts and stratigraphic sections, and a series of paleogeographic maps of Utah. Fifteen fossil collecting localities are listed.





## MAY IS EARTHQUAKE PREPAREDNESS MONTH

The 1981 Utah Legislature passed Senate Joint Resolution No. 4 in its 44th general session, proclaiming the month of May, 1981 as "Earthquake Preparedness Month," "in order that our citizens can better inform themselves about earthquakes and about available emergency procedures and services."

In preparation for the month, Bruce N. Kaliser, UGMS chief engineering geologist, has prepared three circulars for distribution to the public. The three, one page hand outs are entitled, "Earthquake Hazards in Utah," "Earthquake Faulting in Utah," and "Earthquake Safety in Utah". They are to be made available to the state's school districts, P. T. A.'s and county emergency operations centers through the State Offices of Emergency Management. They may also be acquired at no charge, over-the-counter at UGMS's sales office.

Martha Smith, UGMS information officer, has indicated that the circulars will increasingly fulfill a role in answering public enquiries concerning earthquakes in Utah.

## DID YOU KNOW?

There are 8 named islands in the Great Salt Lake .

The average depth of the Great Salt Lake is now 15'.

## TAR SAND TRIANGLE EXPLORATION PROCEEDS

Two companies have been issued permits by the National Park Service to conduct exploratory drilling this summer in and near the Glen Canyon National Recreation Area in the Tar Sand Triangle oil-impregnated sandstone deposit.

Altex Oil Corporation, Denver and Vernal, will drill a wildcat test in the Gordon Flats Area, NW NW 26-30S-16E, Wayne County; and Megadon Energy, Salt Lake City, has been granted access through the GCNRA to a location on BLM-administered lands nearby.

Meanwhile W. C. Kirkwood, Casper, Wyoming, has programmed additional wells in a series of shallow White Rim Sandstone tests begun last year. Eleven such tests, which were extensively cored, were completed in 1980.

## OIL SHALE PLANT IN PRELIM STAGE

Oil Shale Corporation (TOSCO) has contracted with Ralph M. Parsons Company for preliminary design of its Sand Wash oil shale plant in the eastern Uinta Basin. The \$1.5 billion plant is expected to produce 50,000 barrels of oil per day by the late 1980's. About 66,000 tons of shale will be mined underground daily and retorted at the surface using the TOSCO process. The Sand Wash project is located on a 15,000-acre group of State of Utah leases about 35 miles south of Vernal.

## SOHIO TO OPEN PLANT

Sohio Petroleum will open a surface mine and construct a pilot plant to extract oil from oil-impregnated sandstone on Asphalt Ridge 3 miles southwest of Vernal. The plant will process 60 tons per day to produce 24 barrels per day. Completion is scheduled for 1982.

## GREAT SALT LAKE LEVEL

	Boat Harbor (South)	Saline (North)
Feb. 1	4199.80	4198.25
Feb. 15	4199.85	4198.35
Mar. 1	4199.85	4198.40
Mar. 15	4199.95	4198.50
Apr. 1	4200.00	4198.55
Apr. 15	4200.05	4198.60

### UTAH GEOLOGICAL AND MINERAL SURVEY SURVEY NOTES

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